

Factors Affecting the Appearance of ‘Twin Language’: an Original Language Naturally Developing within Twin Pairs

Chisato HAYASHI¹ and Kazuo HAYAKAWA¹

¹Department of Health Promotion Science, Faculty of Health Sciences, Graduate School of Medicine, Osaka University, Osaka, Japan

Abstract

Objectives: The appearance of ‘twin language’ has been highlighted as a reason for delayed language development in twins. ‘Twin language’ is a unique language understandable only within the pair, and not by their mother or others. The purpose of this study was to examine and clarify the factors affecting the appearance of ‘twin language’.

Methods: A mailed questionnaire survey was conducted in 2733 mothers of twins. Of them, 1395 mothers returned the questionnaires. The core questionnaire asked for data on birth weight, age at first spoken word, whether the twins were as alike as two peas in a pod, household members and non-verbal play. Logistic regression analysis was used in this study.

Results: Out of the 1395 pairs included in this analysis, 598 pairs (42.9%) showed the appearance of a ‘twin language’. When the 598 pairs were divided by whether the twin pair was exactly alike or not, there were 112 opposite sex pairs, 105 not-alike male pairs, 106 not-alike female pairs, 129 exactly alike male pairs and 140 exactly alike female pairs. Namely, 38.4% of the opposite sex pairs, 40.4% of the not-alike male pairs, 39.3% of the not-alike female pairs, 47.6% of the exactly alike male pairs and 48.4% in the exactly alike female pairs had a twin language. By multivariate logistic regression analysis controlling for twins’ age, it was found that ‘twin language’ was significantly more frequent in exactly alike twin pairs, pairs with non-verbal play, and pairs with fewer older siblings.

Conclusions: These findings suggest that three factors (whether the twin pair is exactly alike or not, older siblings, non-verbal play) affect the appearance of ‘twin language’.

Keywords: twin, twin language, original language, delayed language development and factors related to linguistic development

Introduction

It has generally been believed that the language development of twins is delayed in comparison with that of singletons because of their low birth weight and postnatal language learning environment - immaturity of physical development and reduced individual conversation with their mother (1-8). However, a recent study suggested that ‘twin language’ affects their delay of normal language development (9). Karen reported that a twin language is ‘one that is private and exclusive to the twin pair’, and linguistic development in twins is delayed because these

languages shut out communication with others (9). In Japan, however, twin language has never been examined.

In 1956, Luria and Yudovich reported this language among twins as ‘autonomous speech’ (2). In addition, Mittler reported that 47 pairs of his sample (100 pairs) of twins had shared a ‘secret language’, but did not discuss this finding (10). There have been only a few previous studies on twin language; however, these studies mostly focused on delay of language development in twins. This delay of language development in twins disappears naturally in early childhood, however, the mothers of twins become anxious because mothers of singletons regard twin language as strange. Some mothers of twins who have twin language stay indoors with the twins, consequently, the linguistic delay continues into primary school age. In addition, the birth rate of twins has increased in recent years because of infertility treatment (11-13), and the problem of linguistic development in twins will be very significant in the future. Therefore, we consider that the twin language phenomenon and its mechanisms of appearance are much more impor-

Received Sep. 4 2003/Accepted Feb. 5 2004

Reprint requestes to: Chisato HAYASHI

Department of Health Promotion Science, Faculty of Health Sciences, Graduate School of Medicine, Osaka University 1-7 Yamadaoka, Suita City, Osaka, 565-0871, Japan

TEL: +81(6)6879-2556, FAX: +81(6)6879-2556

E-mail: chisato@sahs.med.osaka-u.ac.jp

tant from the viewpoints of linguistic science and support for parenting.

In the present research, we hypothesized that twin language is a primitive model of an original language that naturally develops within twin pairs, and examined factors affecting the appearance of twin language. This large-scale study on various factors affecting the appearance of twin language provided reliable results on linguistic developmental aspects.

Methods

Definition of terms

Concerning the term ‘twin language’, there is no common name (e.g., ‘secret language’ or ‘private language’) or ensured definition for such a language; however, twin languages are similar in many respects in that each twin language is unique to a twin pair, and their mother and others cannot understand its meaning. Therefore, we defined ‘twin language’ as a language that is unique to each pair of twins and can not be understood by either their mother or others. Non-verbal play was defined as play that does not involve language (e.g., building with blocks, drawing pictures).

Study population

We published an explanation of our study in the bulletin of the Twin Mothers’ Club (the Japanese Mothers’ Organization for Twin and Higher Order Multiple Births) and recruited participants. The Twin Mothers’ Club is the biggest organization for mothers of twins and higher order multiple births in Japan, and has about 3500 members. We sent questionnaires to 2733 members of the Twin Mothers’ Club who bore twins between April 2, 1988 and April 1, 1997. The period of collecting questionnaires was April and May 1999. Of the 2733 mothers, 1428 mothers of twins (52.3%) responded to the questionnaire. The results of this study were reported by the bulletin of the Twin Mothers’ Club. Fourteen pairs of twins were excluded from this study because of cerebral palsy, a cleft palate, autism or Down’s syndrome to remove influential outliers. The reason these twin pairs were excluded is that these handicaps affect linguistic development. Other diseases and handicaps such as congenital heart disease, asthma of childhood and atopic dermatitis were not excluded.

Moreover, in order to understand each other, not only expression of sound but also perception of sound is necessary. Previous studies on infant acquisition of language reported that a 6-month-old baby can not differentiate natural and unnatural sounds, but a 10-month-old baby can recognize these differences (14). Therefore, we considered that twins under the age of 6 months are unable to use twin language, and the 19 pairs of twins in which the age of first twin language was less than 6 months were excluded from this study. The final total was 1395 respondents (51.0%). Table 1 shows the response rate of each twin pair’s age. The highest response rate was from mothers of 4-year-old twins (54.2%) and the lowest response rate was from mothers of 9-year-old twins (42.2%).

We used the question of ‘whether the twins are as alike as two peas in a pod’ for the classification. Twin pairs for which

Table 1 The response rate of each twin pair’s age

	Total	Response group	
	(n)	(n)	(%)
	2733	1395	51.0%
Twins’ age			
25-35 months (2 years old)	329	162	49.2%
36-47 months (3 years old)	404	216	53.5%
48-59 months (4 years old)	378	205	54.2%
60-71 months (5 years old)	379	194	51.2%
72-83 months (6 years old)	286	150	52.4%
84-95 months (7 years old)	255	128	50.2%
96-107 months (8 years old)	232	116	50.0%
108-119 months (9 years old)	232	98	42.2%
120-131 months (10 years old)	219	116	53.0%
132 months (11 years old)	19	10	52.6%

Table 2 Comparison of rates of twin language by whether the twins were exactly alike or not

	Appearance of twin language			
	Yes		No	
	(n)	(%)	(n)	(%)
All Sample (n=1395: 100%)	598	42.9%	789	56.6%
Opposite sex pairs (n=292: 20.9%)	112	38.4%	180	61.6%
Not-alike pairs of same sex				
Male (n=260: 18.6%)	105	40.4%	154	59.2%
Female (n=270: 19.4%)	106	39.3%	162	60.0%
Exactly alike pairs of same sex				
Male (n=271: 19.4%)	129	47.6%	140	51.7%
Female (n=289: 20.7%)	140	48.4%	147	50.9%

the answer to this question was ‘Yes’ were determined to be exactly alike twin pairs, and twin pairs for which the answer was ‘No’ were determined to be not-alike twin pairs. Thirteen pairs were excluded from this study because it was not possible to determine whether they were exactly alike. The results of classification were 292 opposite sex pairs (20.9%), 260 not-alike male pairs (18.6%), 270 not-alike female pairs (19.4%), 271 exactly alike male pairs (19.4%) and 289 exactly alike female pairs (20.7%) (Table 2).

Questionnaire

The questionnaire included items on the mother’s age (years old), morning sickness (absent/present), toxemia of pregnancy (absent/present), mother’s job (works/does not work), time of weaning (months), length of gestation (weeks), children’s age (months), children’s sex (male or female), body length at birth (cm), body height at 18 months (cm), body weight at birth (g), body weight at 18 months (g), age of first walking (months), age at first tooth (months), age at first spoken word (months), whether the twins were as alike as two peas in a pod (yes/no), whether the twins had a unique language that could not be understood by either their mother or others (yes/no), use of words or sentences in twin language (yes/no), age at first spoken unique language between twins and duration (months), household members (people), type of home (apartment or

detached house), preschool attendance (yes/no), non-verbal play: play that does not involve language (e.g., building with blocks, drawing pictures), and neighborhood friends (yes/no).

Data from the Japanese maternity record book on the physical examination performed on 18-month-old children in the community were used for body height at 18 months (cm) and body weight at 18 months (g). We also asked whether or not the twins showed linguistic delay or other delayed development at the 18-month physical examination. In Japan, the 18-month physical examination is used for the early detection and treatment of developmental delay in children, because physical and linguistic developmental signs are easy to determine in children of this age.

Statistical analysis

We used logistic regression analysis to determine the significance of differences between various variables related to

Table 3 Dummy variable for logistic regression analysis

Twins' age				
Less than 67 months	1			
More than 68 months	0			
Group Classification	variable1	variable2	variable3	variable4
Opposite sex pairs	0	0	0	0
Not-alike pairs of same sex				
Male	1	0	0	0
Female	0	1	0	0
Exactly alike pairs of same sex				
Male	0	0	1	0
Female	0	0	0	1
Disease or Handicap of twins				
No	0			
Yes	1			
Mother with job				
No	0			
Yes	1			
Non-verbal play				
No	0			
Yes	1			
Type of house				
Detached House	0			
Apartment	1			
Preschool attendance				
No	0			
Yes	1			
Neighborhood friends				
No	0			
Yes	1			
Older sibling				
No	0			
Yes	1			
Younger sibling				
No	0			
Yes	1			
Living with grandparents				
No	0			
Yes	1			

linguistic development and the appearance of twin language. In addition, we used multivariate ordered logistic regression models to determine the odds ratio (OR) of the appearance of twin language. The variables introduced in the model were whether the twin pair was exactly alike or not, sex, non-verbal play, existence of older siblings and living with grandparents. Table 3 shows the dummy variable for the logistic regression analysis.

We used SPSS (Version 11.0) for all analyses (15). All p-values presented are two-sided. The 5% significance level was used in the statistical tests.

Results

Table 2 presents a comparison of rates of twin language by whether the twin pair was exactly alike or not and sex. Of the 1395 pairs, 598 pairs (42.9%) exhibited a twin language. Those 598 pairs included 112 opposite sex pairs (38.4%), 105 not-alike male pairs (40.4%), 106 not-alike female pairs (39.3%), 129 exactly alike male pairs (47.6%) and 140 exactly alike female pairs (48.4%).

The overall mean age of all twins was 71.2 months (5 years and 11.2 months) (Table 4). The mean age of the group exhibiting twin language was 68.9 months (5 years and 8.9 months) and the mean age of the group with no twin language was 72.7 months (6 years and 0.7 months). The mean age of the group exhibiting twin language was significantly younger than that of the group with no twin language (p<0.05). Table 4 also displays the distribution of twins' age of groups defined by whether the twins had twin language or not. In twins older than 4 years, more than the half of the pairs were reported as not having twin language. Because approximately half of twins were less than 67.0 months (5 years and 7 months) old, we divided them into two groups using this cut-off point.

Table 5 shows descriptive statistics (mean, SD, variance,

Table 4 The distribution of twins' age of groups defined by whether the twins had twin language or not.

	Total (n)	Appearance of twin language			
		Yes		No	
	(n)	(%)	(n)	(%)	
	1387	598	51.0%	789	49.0%
Mean age (months)	71.2	68.9		72.7	
Median age (months)	67.0	61.0		69.0	
Maximum age (months)	132	132		132	
Minimum age (months)	25	25		25	
Twins' age					
25-35 months (2 years old)	162	83	51.2%	79	48.8%
36-47 months (3 years old)	214	107	50.0%	107	50.0%
48-59 months (4 years old)	204	92	45.1%	112	54.9%
60-71 months (5 years old)	193	73	37.8%	120	62.2%
72-83 months (6 years old)	150	50	33.3%	100	66.7%
84-95 months (7 years old)	128	49	38.3%	79	61.7%
96-107 months (8 years old)	114	48	42.1%	66	57.9%
108-119 months (9 years old)	98	44	44.9%	54	55.1%
120-131 months (10 years old)	114	50	43.9%	64	56.1%
132 months (11 years old)	10	2	20.0%	8	80.0%

Table 5 Descriptive statistics for the variables which are related to language development

	N	Mean	SD	Median	Mode	1st and 3rd quartiles	Minimum	Maximum
Age of mother (years)	1382	35.7	3.9	36.0	36.0	(33.0 38.0)	24.0	51.0
Length of gestation (weeks)	1349	37.0	2.4	37.3	38.0	(36.1 38.4)	24.3	43.1
Time of weaning (months)	1331	13.9	4.9	12.5	12.5	(11.5 15.5)	1.5	38.5
Body length at birth (cm)	2648	45.7	3.2	46.0	45.0	(44.2 48.0)	26.5	54.0
Body height at 18 months (cm)	2669	79.0	4.7	79.5	80.0	(77.4 81.5)	40.5	90.5
Body weight at birth (g)	2764	2351.0	453.8	2384.0	2300.0	(2100.0 2646.0)	468.0	3660.0
Body weight at 18 months (g)	2677	10125.3	1364.7	10200.0	10000.0	(9500.0 10950.0)	1006.0	15150.0
Age of first walking (months)	2747	12.8	2.5	12.0	12.0	(11.0 14.0)	7.0	60.0
Age of first tooth (months)	2565	7.8	2.7	7.0	6.0	(6.0 9.0)	0.0	70.0
Age of first spoken word (months)	2321	13.9	5.1	13.0	12.0	(11.0 17.0)	1.0	60.0
Age at start of twin language (months)	598	21.0	10.2	19.5	24.5	(13.5 24.5)	0.5	118.5
Age at end of twin language (months)	351	34.5	13.0	30.5	13.0	(24.5 36.5)	8.5	84.5
Duration of twin language (months)	330	15.9	12.0	12.0	12.0	(8.0 20.0)	0.0	81.0
Age of the highest frequency of twin language (months)	507	28.3	11.9	24.5	24.5	(22.5 36.5)	3.5	119.5

Table 6 Means, Standard Deviations for Groups Defined by Whether the Twins were exactly alike or not

		Whether twins were exactly alike or not									
		Opposite sex pairs		Not-alike pairs of same sex				Exactly alike pairs of same sex			
				Male pairs		Female pairs		Male pairs	Female pairs		
		N=292		N=260		N=270		N=271		N=289	
Age of mother (years)	SD	35.8	3.8	35.8	3.9	35.7	3.9	35.7	4.1	35.6	3.9
Length of gestation (weeks)	SD	37.0	2.3	37.0	2.6	36.9	2.4	37.0	2.3	37.1	2.4
Time of weaning (months)	SD	13.7	4.5	13.8	4.4	14.2	4.9	14.0	5.1	13.7	5.5
		Male	Female	Male1*	Male2**	Female1*	Female2**	Male1	Male2	Female1	Female2
Body length at birth (cm)	SD	45.9	45.2	46.3	45.8	45.5	44.9	46.2	45.9	45.6	45.7
		3.0	3.3	2.9	3.5	3.1	3.6	2.9	3.2	3.2	3.0
Body height at 18 months (cm)	SD	79.6	78.4	79.2	79.1	78.7	78.3	80.2	80.2	78.4	78.1
		4.8	5.0	6.3	5.5	3.8	4.2	3.7	3.8	4.4	4.9
Body weight at birth (g)	SD	2414.0	2305.4	2417.9	2349.0	2356.8	2235.0	2430.4	2352.1	2351.1	2296.2
		443.5	425.1	450.0	481.7	444.3	514.1	423.2	460.8	441.4	427.3
Body weight at 18 months (g)	SD	10421.8	9808.3	10353.7	10217.5	9978.5	9770.9	10541.3	10463.2	9917.8	9844.0
		1291.3	1298.5	1498.3	1514.8	1213.2	1297.1	1392.8	1279.3	1296.5	1298.8
Age of first walking (months)	SD	13.3	13.4	12.7	12.7	12.6	12.5	12.8	13.0	12.8	12.8
		2.1	2.4	2.5	2.3	2.5	2.6	2.1	3.6	2.4	2.5
Age of first tooth (months)	SD	8.1	8.6	7.7	8.1	7.7	7.8	7.6	7.6	7.8	7.9
		2.6	2.8	2.7	4.8	2.2	2.5	2.2	2.3	2.5	2.5
Age of first spoken word (months)	SD	15.1	11.9	14.6	14.7	13.2	13.5	14.9	15.2	13.3	13.4
		5.4	4.9	5.3	5.5	3.9	4.1	5.2	6.4	4.3	4.5
		N=112		N=105		N=106		N=129		N=140	
Age at start of twin language (months)	SD	22.4	7.6	21.5	7.7	21.3	8.0	21.3	8.9	23.2	10.3
Age of the highest frequency of twin language (months)	SD	27.8	10.4	26.5	8.0	27.0	10.4	28.5	11.8	30.3	12.6
Duration of twin language (months)	SD	13.3	9.2	14.3	10.1	13.6	8.4	15.0	8.0	15.8	10.4

*Male1 and Female1 are first child. **Male2 and Female2 are second child.

median, mode, 1st and 3rd quartiles, minimum and maximum) for the 14 variables which relate to language development (age of mother, length of gestation, time of weaning, body length at birth, body height at 18 months, body weight at birth, body weight at 18 months, age of first walking, age of first tooth, age of first spoken word, age at start of twin language, age at end of twin language, duration of twin language and age of the highest frequency of twin language). Out of the 14 variables, 7 variables (body length at birth, body height at 18 months, body weight at birth, body weight at 18 months, age of first walking, age of first tooth, age of first spoken word) had double cases because the mother had two children. Therefore, we made the definition in same sex pairs state that the first male child was male 1, the first female child was female 1, the second male child was male 2 and the second female child was female 2. We made a quartile-quartile plot of each variable versus theoretical quartiles from a normal distribution. As a result, the distribution of every variable except age at end of twin language and duration of twin language was close to linear, therefore, we regard them as normal distributions.

Next, we calculated the mean and standard deviation by whether the twin pair was exactly alike or not and the sex difference for every variable except age at end of twin language and duration of twin language (Table 6). The mean age at the first word was 15.1±5.4 (mean±SD) months in the male twins of opposite sex pairs, 11.9±4.9 months in the female twins of opposite sex pairs, 14.6±5.3 (male1) and 14.7±5.5 (male2) months in not-alike male pairs, 13.2±3.9 (female1) and 13.5±4.1 (female2) months in not-alike female pairs, 14.9±5.2 (male1) and 15.2±6.4 (male2) months in exactly alike male pairs and 13.3±4.3 (female1) and 13.4±4.5 (female2) months in exactly alike female pairs. It was shown that the female twins of opposite sex pairs tended to say the first word earlier than not-alike male pairs, not-alike female pairs, exactly alike male pairs and exactly alike female pairs.

In addition, the mean age at the first twin language was 22.4±7.6 (mean±SD) months in opposite sex pairs, 21.5±7.7 months in not-alike male pairs, 20.88.0 months in not-alike female pairs, 21.3±8.9 months in exactly alike male pairs and 23.2±10.3 months in exactly alike female pairs. The mean duration of speaking a twin language was 13.3±9.2 months in opposite sex pairs, 14.3±10.1 months in not-alike male pairs, 13.6±8.4 months in not-alike female pairs, 15.0±8.0 months in exactly alike male pairs and 15.8±10.4 months in exactly alike female pairs. Moreover, age of the highest frequency of twin language was 27.8±10.4 months in opposite sex pairs, 26.5±8.0 months in not-alike male pairs, 27.0±10.4 months in not-alike female pairs, 28.5±11.8 months in exactly alike male pairs and 30.3±12.6 months in exactly alike female pairs. It follows from this that twin language starts at about 20 months and disappears by 3 years of age.

Figure 1 shows a box-and-whisker plot of two variables (age at end of twin language and duration of twin language) that were not regarded as having normal distribution. The median age at end of twin language was 30.5 months in opposite sex pairs and not-alike pairs, 35.0 months in exactly alike male pairs and 36.5 months in exactly alike female pairs. Figure 1 also illustrates that the 3rd quartile for age at end of twin

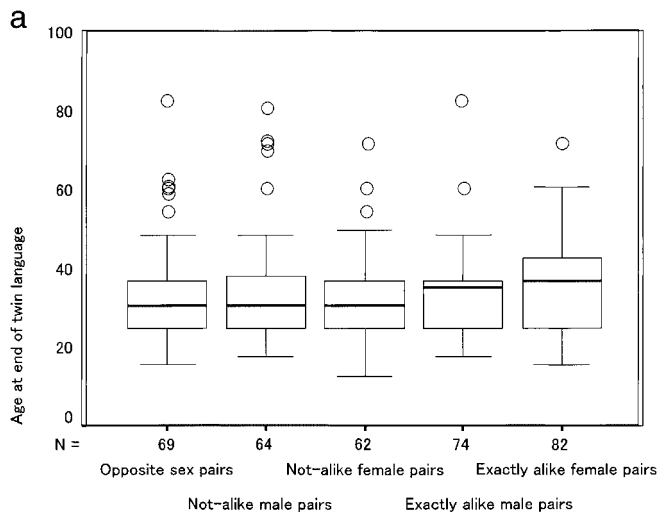


Fig. 1(a) Mean, 1st and 3rd quartiles, minimum and maximum of age at and end of twin language

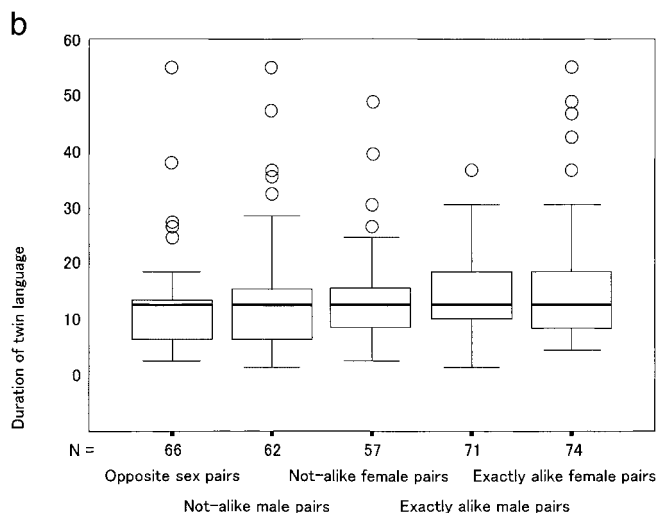


Fig. 1(b) Mean, 1st and 3rd quartiles, minimum and maximum of duration of twin language

language of exactly alike female pairs (42.5 months) was later than that of opposite sex pairs (36.5 months), not-alike male pairs (38.8 months), not-alike female pairs (36.5 months), and exactly alike male pairs (36.5 months). On the other hand, the median in duration of twin language was 12 months in every group and the 1st and 3rd quartiles were (6 months, 13.5 months: 1st quartile, 3rd quartile) for opposite sex pairs, (6 months, 15.8 months) for not-alike male pairs, (8 months, 15.5 months) for not-alike female pairs, (9.0 months, 18.0 months) for exactly alike male pairs and (8.0 months, 18.0 months) for exactly alike female pairs.

Table 7 presents the results of the logistic regression analysis for each categorical variable, for studying the association between various variables related to linguistic development and the appearance of twin language. Logistic regression analysis of the appearance of twin language as the dependent variable, and twins' age, whether the twin pair was exactly alike or not, and variables related to linguistic development as independent variables, was used. As seen in this table, twins' age, whether the twin pair was exactly alike or not and several

Table 7 Crude odds ratio (OR) and 95% CI for the association of environmental factors and twin language

		Appearance of twin language		
				p-value
Twins' age				
Less than 67 months	N=689	1.332	(1.076–1.649)	0.008**
More than 68 months	N=706	1		
Whether twins were exactly alike or not				
Opposite sex pairs N=292		1		
Not-alike pairs of same sex				
Male	N=260	1.068	(0.762–1.497)	
Female	N=270	1.025	(0.733–1.433)	
Exactly alike pairs of same sex				
Male	N=271	1.436	(1.026–2.011)	0.036*
Female	N=284	1.492	(1.077–2.066)	
Disease or Handicap of twins				
No N=979		1		0.379
Yes N=403		1.110 (0.880–1.402)		
Mother with job				
No N=1188		1		0.181
Yes N=151		1.625 (0.894–1.789)		
Non-verbal play				
No N=979		1		0.000***
Yes N=351		2.238 (1.747–2.868)		
Type of house				
Detached House N=654		1		0.114
Apartment N=725		0.842 (0.680–1.042)		
Preschool attendance				
No N=1077		1		0.153
Yes N=302		0.828 (0.638–1.074)		
Neighborhood friends				
No N=700		1		0.459
Yes N=675		0.923 (0.745–1.142)		
Older sibling				
No N=935		1		0.000***
Yes N=442		0.629 (0.498–0.794)		
Younger sibling				
No N=1230		1		0.340
Yes N=147		0.844 (0.595–1.197)		
Living with grandparents				
No N=1100		1		0.016**
Yes N=277		0.719 (0.549–0.942)		

*p<0.05 **p<0.01 ***p<0.001.

variables related to linguistic development, non-verbal play, older siblings and living with grandparents, were found to be significant in the appearance of twin language.

An age of less than 67 months was positively related to the appearance of twin language (OR=1.332) compared to an age of more than 68 months. Exactly alike male pairs were positively related to the appearance of twin language (OR=1.436) compared to opposite sex pairs. Exactly alike female pairs were also positively related to the appearance of twin language (OR=1.492) compared to opposite sex pairs.

In addition, non-verbal play was strongly and positively related to the appearance of twin language (OR=2.238). The

Table 8 Multiple logistic analysis for independent predictors of twin language controlling for twins' age

Variable	Multivariate odds ratio (95%CI)	P-value
Opposite sex pairs	1	
Not-alike pairs of same sex		
Male	1.143(0.797–1.639)	0.467
Female	1.157(0.811–1.651)	0.422
Exactly alike pairs of same sex		
Male	1.565(1.093–2.243)	0.015*
Female	1.852(1.304–2.631)	0.001**
Non-verbal play	2.274(1.762–2.936)	0.000***
Older sibling	0.595(0.465–0.762)	0.000***
Living with grandparents	0.779(0.585–1.038)	0.088

*p<0.05 **p<0.01 ***p<0.001.

existence of an older sibling was strongly negatively related to the appearance of twin language (OR=0.629). Moreover, living with grandparents also showed a negative influence (OR=0.719). We did not observe an association with variables of disease or handicap, mother having a job, preschool attendance, neighborhood friends and younger siblings.

In an ordered multivariate logistic regression controlling for age, the association with grandparents was not significant (Table 8). Three variables, whether the twin pair was exactly alike or not, non-verbal play, and older siblings, remained significant variables.

Discussion

In this study, we aimed to clarify the relationship between several factors related to linguistic development and the appearance of twin language. In particular, we explored the effects of whether the twin pair was exactly alike or not and household members on the appearance of twin language. The findings indicated that whether the twin pair was exactly alike or not and several factors related to linguistic development, and above all, non-verbal play and having an older sibling, showed a correlation to the appearance of twin language. From this, it follows that, compared to not-alike pairs, exactly alike pairs are significantly more likely to develop a twin language. Judging from the above, it may be presumed that there is some relationship between appearance of twin language and zygosity. Previous studies have reported that more than 90% of twins were diagnosed correctly using the questionnaire item of 'whether twins are as like as two peas in a pod' (16-18). The future direction of this study will be a more detailed examination of the relationship between zygosity and appearance of twin language.

In a recent study, a relationship between specific language impairment and twin language was reported (19, 20). Moreover, a relationship was shown between heredity and specific language impairment (21-24). However, whether twin language indicates language impairment remains to be clarified. Alternatively, it could be argued that twin language is a unique way to express feelings, and does not represent impairment. As Bakker pointed out, because twins grow up closely together during the language acquisition period, they use each other as a model and

acquire language imperfectly (25). In addition, in a previous study, the possibility was suggested that frequently heard labels for objects would be better remembered and better articulated than other words once the child begins to develop a productive vocabulary of true words (6).

In addition, the findings showed that twins who frequently exhibited non-verbal play and who didn't have an older sibling were significantly more likely to have a twin language. In recent papers published in 2000 (26) and 2002 (27), Plomin proposed a new interpretation of the structure of language abilities derived from genetic and environmental effects, using multivariate genetic analysis of a twin population. What was demonstrated in his study was that genetic effects on verbal and non-verbal abilities are largely independent in 2-year-old; however, genetic effects on language and other cognitive abilities overlap substantially at 4 years of age. It follows that the 2-year period from the age of 2 to 4 years is very important in the development of language and other cognitive abilities.

As shown in this study, twin pairs who frequently exhibited non-verbal play were significantly more likely to have a twin language, and also, twin language occurred at about 20 months and disappeared by about 3 years of age. Reflection on some of these findings confirms that there is some relationship between the occurrence of twin language and non-verbal play in infancy.

Moreover, Lenneberg (28) stated that singleton children at 18 months still show much babbling with several syllables and an intricate intonation pattern, but there is no attempt to communicate information and no frustration at not being understood. In addition, singleton children at 30 months are not babbling at all, and their utterances have communicative intent and they are frustrated if they are not understood by adults.

It is considered from this that twin pairs start to utter meaningless sounds to each other at about 18 months and these sounds develop into twin language from 20 months. They try to communicate with twin language within the twin pair and with their mother, and most twin language disappears by 36 months because twin language is not understood by their mother and other adults and the twins become frustrated. In twin pairs with a strong connection, it is considered that twin language persists. Therefore, twin pairs who use twin language have delayed language development.

In addition, some researchers have reported that children acquire their mother language by interaction with their parents, especially during play. It is considered that twin pairs develop twin language in their daily interaction with each other, especially during play. In addition, in a previous study, the possibility was suggested that frequently heard labels for objects would be better remembered and better articulated than other words once

the child begins to develop a productive vocabulary of true words (6).

Most researchers suggest that joint attention, symbolic play and language skills are tightly bound (29-32). This research grew out of Piaget's ideas about the shared sensorium origins of linguistic and nonlinguistic symbols (33). In several studies (34), it was shown that between 24 and 30 months of age, on average, there is an explosion in grammar, with a progression from the bare telegrams of 20-month-old children to speaking more ornate sentences with inflections and freestanding functional words.

To sum up, it was suggested that the following factors are related to the appearance of twin language. First, twins have less conversation with their parents. Second, twins spend much time together and frequently hear mutual language at the time that is important for language acquisition. Third, frequent non-verbal play may reflect good communication of twins, and in addition, good communication may affect the development of unique vocabulary among twins. Fourth, if there were older siblings, twins had fewer hours of twin-only time and more chances to hear their native tongue. Therefore, it is considered that the appearance of twin language is influenced by these factors.

This study is one of the largest studies of twin language, yet it has several potential limitations. One of the limitations is that this study had no information such as uncertainty about some non-verbal developmental information such as searching and tasks, and the impossibility of conducting a more detailed analysis on the developmental stages of twins. Second, we could not look at the characteristics of the non-answer group because we didn't have information on these mothers. Third, the mean age of the group exhibiting twin language was significantly younger than that of the group with no twin language ($p < 0.05$). Moreover, mothers of twins who were 5 to 7 years old tended to answer that they didn't witness twin language in their children, more frequently than the other mothers. However, we couldn't find any factors influencing this tendency.

The birth rate of twins has increased in recent years because of infertility treatment, and the problem of the linguistic development of twins will be very significant in the future. We still know very little about how twin language develops, and thus, basic research on the process of development of twin language will be critical.

Acknowledgements

This work was supported in part by the Twin Mothers' Club (the Japanese Mothers' Organization for Twin and Higher Order Multiple Births).

References

- (1) Day EJ. The development of language in twins. *Child Dev.* 1932; 3: 179-199.
- (2) Savic S. How twins learn to talk. New York: Academic Press, 1980.
- (3) McKeown T, Record R. Observations of foetal growth in multiple pregnancies in man. *J Endocrinol.* 1952; 8: 386-401.
- (4) Bornstein M, Ruddy M. Infant attention and maternal stimulation: Prediction of cognitive and linguistic development in singletons and twins. In H. Bouma, D. Douwhuis (Eds.), *Attention and performance X; Control of language processes.*

- London. Erlbaun, 1984.
- (5) Tomasello M, Mannle S, Kruger AC. Linguistic environment of 1- to 2-year-old twins. *Dev Psychol.* 1986; 22(2): 169–176.
 - (6) Lytton H, Conway D, Sauve R. The impact of twinship on parent-child interaction. *J Pers Soc Psychol.* 1977; 35(2): 97–107.
 - (7) Conway D, Lytton H, Pysh F. Twin-singleton language differences. *Can J Behav Sci.* 1980; 12: 264–271.
 - (8) Wells G. *Learning through interaction: The study of language development.* Cambridge: Cambridge University Press, 1979.
 - (9) Thorpe K, Greenwood R, Eivers A, Rutter M. Prevalence and developmental course of ‘secret language’. *Int J Lang Commun Disord.* 2001; 36(1): 43–62.
 - (10) Mittler P. Biological and social aspects of language development in twins. *Dev Med Child Neurol.* 1970; 12: 741–757.
 - (11) Birmingham Alabama. Assisted reproductive technology in the United States: 1998 results generated from the American Society for Reproductive Medicine/Society for Assisted Reproductive Technology Registry. *Fertility and Sterility.* 2002; 77(1) 18–31.
 - (12) S.K. Kalra, M.P. Milad, S.C. Klock and W.A. Grobman. Infertility Patients and Their Partners: Differences in the Desire for Twin Gestations. *The American College of Obstetricians and Gynecologists.* 2003; 102(1) 152–155.
 - (13) Komori S, Kasumi H, Horiuchi I, Hamada Y, Suzuki C, Shigeta M and Koyama K. Prevention of multiple pregnancies by restricting the number of transferred embryos: randomized control study. *Archives of Gynecology and Obstetrics.* 2003; Springer-Verlag.
 - (14) Hayashi A, Deguchi T, Tamekawa Y, Kiritani S. Developmental change in preferential listening responses for prosodic patterns of speech stimuli in 4-to 14-month-old: perception of prosodic cues to clausal units. *Annual Research Reports of Tokyo Gakugei University. The Research Institute for Education of Exceptional Children.* 1997; 87–94.
 - (15) SPSS Base 11.0 User’s Guide. Copyright 2001 by SPSS Inc.
 - (16) Ooki S, Yamada K, Asaka K, Hayakawa K. Zygosity diagnosis of twins by a questionnaire. *Acta Genet Med Gemellol (Roma)* 1990; 39: 109–115.
 - (17) Ooki S, Yamada K, Asaka A, Hayakawa K, Shimizu T. Zygosity diagnosis of twins by questionnaire. *Minzokueisei.* 1989; 55: 227–235.
 - (18) Hayakawa K, Shimizu T, Kanemitsu Y. Zygosity diagnosis of twins by questionnaire in middle age. *Jpn J Pub Health.* 1985. 33. 340–344 (in Japanese).
 - (19) Bishop DVM, Bishop SJ. ‘Twin language’: A risk factor for language impairment? *J Speech Hear Res.* 1998; 41(1): 150–160.
 - (20) Bishop DVM, Delaney T et al. Different origin of auditory and phonological processing problems in child with language impairment: Evidence from a twin study. *J Speech Hear Res.* 1999; 42: 142–154.
 - (21) Price TS, Eley TC, Dale PS, Stevenson J, Saudino K, Plomin R. Genetic and environmental covariation between verbal and nonverbal cognitive development in infancy. *Child Dev.* 2000; 71(4): 948–959.
 - (22) Meaburn E, Dale PS, Craig IW, Plomin R. Language impaired children; No sign of the FOXP2 mutation. *Neuroreport.* 2002; 1075–1077.
 - (23) Colledge E, Bishop DVM, Schomerus GK, Price TS, Dale PS, Plomin R. The structure of language abilities at 4 years. A twin study. *Dev Psychol.* 2002; 38(5): 749–757.
 - (24) Dale PS, Simonoff E, Bishop DVM, Eley TC, Oliver B, Price TS et al. Genetic influence on language delay in two-year-old children. *Nat Neurosci.* 1998; 1(4): 324–328.
 - (25) Bakker P. Autonomous languages of twins. *Acta Genet Med Gemellol (Roma).* 1987; 36(2): 233–238.
 - (26) Price TS, Eley TC, Dale PS, Stevenson J, Saudino K, Plomin R. Genetic and environmental covariation between verbal and nonverbal cognitive development in infancy. *Child Dev.* 2000; 71(4): 948–959.
 - (27) Colledge E, Bishop DVM, Schomerus GK, Price TS, Dale PS, Plomin R. The structure of language abilities at 4 years. A twin study. *Dev Psychol.* 2002; 38(5): 749–757.
 - (28) Lenneberg E H. *Biological foundations of language.* 1967. New York.
 - (29) Hanna E, Meltzoff AN. Peer imitation by toddlers in laboratory, home, and day-care contexts: Implications for social learning and memory. *Dev Psychol.* 1993; 29: 701–710.
 - (30) Meltzoff A N. Immediate and deferred imitation in fourteen- and twenty-four-month-old infants. *Child Dev.* 1985; 56: 62–72.
 - (31) Meltzoff A N, Moore M K. Imitation of facial and manual gestures by human neonates. *Science.* 1977; 198: 75–78.
 - (32) Meltzoff A N, Moore M K. Imitation in newborn infants: Exploring the range of gestures imitated and the underlying mechanisms. *Dev Psychol.* 1989; 25: 954–962.
 - (33) Piaget J. *Play, dreams, and imitation.* New York: Norton. 1951.
 - (34) Bates E, Dick F. Language Gesture, and the Developing Brain. *Dev Psychobiol.* 2002. 40: 293–310.